

1           CLAIMS:

2       1. A method of forming a thin film transistor relative to a  
3       substrate comprising the following steps:

4           providing a thin film transistor layer of polycrystalline material on  
5       a substrate, the polycrystalline material comprising grain boundaries;

6           providing a fluorine containing layer adjacent the polycrystalline  
7       thin film layer;

8           annealing the fluorine containing layer at a temperature and for  
9       a time period which in combination are effective to drive fluorine from  
10      the fluorine containing layer into the polycrystalline thin film layer and  
11      incorporate fluorine within the grain boundaries to passivate said grain  
12      boundaries; and

13           providing a transistor gate operatively adjacent the thin film  
14      transistor layer.

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16       2. The method of forming a thin film transistor of claim 1  
17       wherein the thin film transistor layer is provided before the fluorine  
18       containing layer is provided.

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20       3. The method of forming a thin film transistor of claim 1  
21       wherein the thin film transistor layer is provided after the fluorine  
22       containing layer is provided.

1       4. The method of forming a thin film transistor of claim 1  
2       wherein the fluorine containing layer predominately comprises  $WSi_x$ .

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4       5. The method of forming a thin film transistor of claim 1  
5       wherein the fluorine containing layer predominately comprises elemental  
6       W.

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8       6. The method of forming a thin film transistor of claim 1  
9       wherein the fluorine containing layer comprises W, and is deposited by  
10      chemical vapor deposition using  $WF_6$  as a precursor.

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12      7. The method of forming a thin film transistor of claim 1  
13      wherein the annealing temperature is from about 600°C to about 1000°C.

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15      8. The method of forming a thin film transistor of claim 1  
16      wherein the annealing temperature is less than 700°C.

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18      9. The method of forming a thin film transistor of claim 1  
19      further comprising providing a buffering layer intermediate the thin film  
20      transistor layer and the fluorine containing layer, the buffering layer  
21      being transmissive of fluorine from the fluorine containing layer during  
22      the annealing step.

10. The method of forming a thin film transistor of claim 1 further comprising providing a buffering layer intermediate the thin film transistor layer and the fluorine containing layer, the buffering layer being transmissive of fluorine from the fluorine containing layer during the annealing step, the buffering layer having a thickness of less than or equal to about 200 Angstroms.

11. A thin film transistor produced according to the process of  
claim 1.

1       12. A method of forming a thin film transistor relative to a  
2       substrate comprising the following steps:

3       providing a thin film transistor layer of polycrystalline material on  
4       a substrate, the polycrystalline material comprising grain boundaries;

5       providing a sacrificial fluorine containing layer over the  
6       polycrystalline thin film layer;

7       annealing the fluorine containing layer at a temperature and for  
8       a time period which in combination are effective to drive fluorine from  
9       the fluorine containing layer into the polycrystalline thin film layer and  
10      incorporate fluorine within the grain boundaries to passivate said grain  
11      boundaries;

12      after annealing, etching the sacrificial layer from the polycrystalline  
13      thin film layer; and

14      providing a gate dielectric layer and a gate relative to the  
15      passivated polycrystalline thin film layer.

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17      13. The method of forming a thin film transistor of claim 12  
18      wherein the gate dielectric layer and gate are provided after etching the  
19      sacrificial layer.

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21      14. The method of forming a thin film transistor of claim 12  
22      wherein the gate dielectric layer and gate are provided before etching  
23      the sacrificial layer.

1        15. The method of forming a thin film transistor of claim 12  
2        wherein the gate dielectric layer and gate are provided before providing  
3        the sacrificial layer.

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5        16. The method of forming a thin film transistor of claim 12  
6        wherein the fluorine containing layer predominately comprises  $WSi_x$ .

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8        17. The method of forming a thin film transistor of claim 12  
9        wherein the fluorine containing layer predominately comprises elemental  
10      W.

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12      18. The method of forming a thin film transistor of claim 12  
13      wherein the fluorine containing layer comprises W, and is deposited by  
14      chemical vapor deposition using  $WF_6$  as a precursor.

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16      19. The method of forming a thin film transistor of claim 12  
17      wherein the annealing temperature is from about 600°C to about 1000°C.

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19      20. The method of forming a thin film transistor of claim 12  
20      wherein the annealing temperature is less than 700°C.

1           21. The method of forming a thin film transistor of claim 12  
2 further comprising providing a buffering layer intermediate the thin film  
3 transistor layer and the fluorine containing layer, the buffering layer  
4 being transmissive of fluorine from the fluorine containing layer during  
5 the annealing step, the method further comprising etching the buffering  
6 layer from outwardly of the polycrystalline thin film layer after the step  
7 of etching the fluorine containing layer.

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9           22. The method of forming a thin film transistor of claim 12  
10 further comprising providing a buffering layer intermediate the thin film  
11 transistor layer and the fluorine containing layer, the buffering layer  
12 being transmissive of fluorine from the fluorine containing layer during  
13 the annealing step, the buffering layer having a thickness of less than  
14 or equal to about 200 Angstroms, the method further comprising etching  
15 the buffering layer from outwardly of the polycrystalline thin film layer  
16 after the step of etching the fluorine containing layer.

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18           23. A thin film transistor produced according to the process of  
19 claim 12.  
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1           24. A method of forming a thin film transistor relative to a  
2 substrate comprising the following steps:

3           providing a thin film transistor layer of polycrystalline material on  
4 a substrate, the polycrystalline material comprising grain boundaries;

5           providing a fluorine containing layer adjacent the polycrystalline  
6 thin film layer; and

7           annealing the fluorine containing layer at a temperature sufficiently  
8 high to drive fluorine from the fluorine containing layer into the  
9 polycrystalline thin film layer and incorporate fluorine within the grain  
10 boundaries to passivate said grain boundaries but sufficiently low to  
11 prevent chemical reaction of the fluorine containing layer with the  
12 polycrystalline thin film layer.

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14           25. The method of forming a thin film transistor of claim 24  
15 wherein the thin film transistor layer is provided before the fluorine  
16 containing layer is provided.

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18           26. The method of forming a thin film transistor of claim 24  
19 wherein the thin film transistor layer is provided after the fluorine  
20 containing layer is provided.

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22           27. The method of forming a thin film transistor of claim 24  
23 wherein the fluorine containing layer predominately comprises  $WSi_x$ .

1           28. The method of forming a thin film transistor of claim 24  
2       wherein the fluorine containing layer predominately comprises elemental  
3       W.

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5           29. The method of forming a thin film transistor of claim 24  
6       wherein the fluorine containing layer comprises W, and is deposited by  
7       chemical vapor deposition using WF<sub>6</sub> as a precursor.

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9           30. The method of forming a thin film transistor of claim 24  
10      wherein the annealing temperature is less than 700°C.

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12       31. The method of forming a thin film transistor of claim 24  
13      further comprising providing a buffering layer intermediate the thin film  
14      transistor layer and the fluorine containing layer, the buffering layer  
15      being transmissive of fluorine from the fluorine containing layer during  
16      the annealing step, the buffering layer having a thickness of less than  
17      or equal to about 200 Angstroms.

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19       32. A thin film transistor produced according to the process of  
20      claim 24.